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THE UTES MULTIPURPOSE RADAR COMPLEX

by

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13. ABSTRACT

The article briefly describes the UTES radar complex, intended for multipurpose use in civilian air-traffic control (height 20 m, parabolic reflector grid [18 x 10.5 m] range 450 km at high altitudes). The physical layout of the equipment room is described as well as several features giving UTES a decided advantage over similar foreign models. There are six photographs.

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Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

* ye initially, after vowels, and after ъ, ь; e elsewhere. When written as ё in Russian, transliterate as yё or ё. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

THE UTES MULTIPURPOSE RADAR COMPLEX

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I first saw it at the Exhibition of Achievements of the National Economy of the USSR. The exhibit was called: "Civilian Air Traffic Control Radar Complex. Code name — UTES."

I became closely acquainted with this radar complex somewhat later at one of the airports. Here it seemed to be even more impressive than at the exhibit. Twenty meters high, the parabolic reflector grid [18 × 10.5 m] rythmically rotated. Together with the protruding double-horn exciter it formed an electromagnetic field in the air space. The radiation pattern of an antenna of such configuration makes it possible to follow on the radarscopes the flight of aircraft within a radius of 450 km and at high altitudes. The complex has range advantages over similar-purpose foreign radar such as the AR-5 [Plessey, Great Britian], ATCR-2 [Selenia, Italy] or LRN-4c [Toshiba, Japan].

The UTES has one transmitting-receiving antenna. Electromagnetic oscillations from the output of the two transmitters through the antenna switches, power combination unit, and the rotating coupling are fed to the parabolic reflector and radiated into space. Meeting a plane, they are reflected from its surface, returned and are picked up by the receivers. This is a simplified view of the mechanism of passing radar signals.

All the radar transmitting and receiving equipment are in a

building located next to the antenna tower. In the equipment room there are rows of rack panel-mountings. No person is present among the labryinth of electronic objects, where at particular points the power of the electromagnetic oscillations reaches six million watts: the receiving-transmitting equipment and the antenna-feeder system of the complex are designed for long and continuous operation without the constant presence of operating personnel. The high-frequency part of the radar is remotely controlled and monitored from another place – the control tower, which can be up to 10 km away. Such design makes it possible to select the most optimum location for the radar tower [taking into consideration minimum (ground) cover elevation angles], and to keep the antenna out of the aircraft take-off and landing approach zones.

The UTES works round-the-clock, continuously passing information on moving targets. Its high reliability is assured by 100% redundancy of all the basic units and instruments. The switch to stand-by is automatic. The repair of one of the subassemblies never affects the work of another. The average time required for the operating personnel to restore the equipment to working order does not exceed 25 minutes. The dependability and life of the radio-electronic equipment in the complex is largely determined by the new electronic components used in its construction. Thus, there is less than 1.6% electronic-tube instruments used in the overall number of parts.

The UTES has a parasitic as well as an operating radar. The first is two coordinates of the aircraft–range and azimuth [the angle formed by the direction to the target and to true North]. The second, using a responder, which is on board the aircraft, determines the third coordinate – altitude. It also gives additional information about the number of engines and the fuel reserve in the tanks. The parasitic and operating radars are actually a stand-by for one another during the control of aircraft equipped with airborne responders.

Completely answering the requirements of the International

Civil Aviation Organization [ICAO], UTES can be used not only autonomously, but also in an automated air traffic control system. It contains equipment which gives both radar and additional information in binary code. This makes it possible to connect the radar complex with an electronic computer, and, moreover, to input the information into a multiplex apparatus for transmission of narrow-band communication lines [telephone lines].

The relay equipment assures the transmission of the radar information from the radar complex to the airport control tower. The information is sent from the radar complex to the control tower through the operators' panels. Their number is a function of the number of sectors into which a given air traffic control region is divided. An operator's panel has a plan-position indicator [PPI], large-scale indicator [LSI] and a digital panel [four aircraft]. Alongside in the equipment room is the engineering panel, from which the entire complex is controlled and monitored. There is also the equipment for generating the electrical signals of the contour air-route chart.

The equipment in the UTES radar complex control tower lets twenty operators handle flights in different sectors of the air space at the same time. Twenty-four primary indicators with digital panels and five extras make it possible to determine the location of aircraft, the direction of air flight and their location with respect to one another accurate to 800 meters in range and 30 minutes azimuth. The indicator screens on the operators' panels have great ranges of scales: 100, 250, and 500 km in radius in a circular-scan regime; 200 and 500 km in diameter in the sector mode. The start of the PPI sweep in the sector mode can be set at any point on the screen. The optimum matching of the contour air-route chart with the radar range on the screens is assured. The image has ten-kilometer marks, which allows the operator to determine easily the distance covered by a plane along the air route from the control tower. The accuracy of plotting the contour air route charts on the PPI screens is ±1 km in range, ±0.25° in azimuth.

Each operator independently of his callers, working with him at the control tower, can select any scale on the indicator or one of the two previously selected scan sectors. He independently sets the automatic tracking; a separation mode exists, in which the aircraft blips, moving at given altitudes, are marked on the indicator screens.

In order to observe aircraft against a background of reflection from so-called local objects [mountains, forests, artifical structures] and meteorological formations [rain, fog, clouds], UTES has a built-in moving-target selector. It assures the visibility of aircraft against a background of local objects in any weather. I had the occasion to observe the moving-target selector when a fog settled in around the airport for 60 km. A continuous light spot with ragged edges appeared on the PPI screen. All aircraft in this zone were, as it were, dissolved in the white "milk" of the reflections, but the operator threw the switch of the moving target selector and the screen again became clear. It was as if the fog did not exist. The blips from the aircraft went on their way without hindrance.

Great range of the parasitic and working channels, high precision and discrimination, increase in the number of simultaneously tracked targets - this is not even a complete list of merits of the new civilian air traffic control radar. In the opinion of specialists who have used UTES, the possibilities of this complex promote not only an increase in the safety and regularity of flights, but also a growth of their economy, efficiency of using the air space, increase of the handling capacity of airports.

KEY: General View of UTES.

(1)

KEY: (1) Operator's panel at the control tower.

Indicator screen of the operator's panel, lighted by moving-target selection. Scale -- 100 km. Moving-target selection is introduced at a radius of 40 km.

Equipment room

Switched-on indicator of the operator's panel in the circular scan mode.

Indicator screen in the sector mode.